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ABSTRACT

This bibliography brings together sources, through August 1991, on the National Research and Education Network (NREN) and related topics, including computer networks, databases, information technology, library automation, microcomputers, and online systems. Where possible, a brief biographical note on the author is included, and most of the entries are annotated. The list is alphabetical by author, and a source index citing the entry number follows the bibliography. The 255 references are taken from such publications as "Academic Computing," "The Chronicle of Higher Education," "Computerworld," "EDUCOM Bulletin," "EDUCOM Review," "Library Hi Tech News," "Network World," "PC Week," "Publishers Weekly," "Scientific American," and "Telecommunications." Several congressional hearings are also cited, including those on computer networks and the High Performance Computing Act, as well as those concerning the NREN itself. (DB)

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THE NATIONAL RESEARCH AND EDUCATION NETWORK (NREN): A Bibliography

Compiled by

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September 12, 1991

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INTRODUCTION

This bibliography is an attempt to compile in one source as complete a bibliography on NREN and related topics as possible. It attempts to be complete up through the end of August, 1991.

Although a thorough effort was made to be complete, this bibliography is not exhaustive. Some sources were unavailable in the time allotted to complete it. The preponderance of sources was examined first hand, although some sources not seen by the compiler were included if there was reason to believe that the source was both bibliographically accurate and directly relevant to NREN. It also became apparent that there was a great deal of repetition among news stories. It was decided that major stages in news events about NREN should be reported, but that it was redundant to attempt to cite them in every news source where notice was made. If substantive new material was included in news source, an effort was made to include them in the bibliography.

Where possible, a brief biographical note on the author was included. The list is alphabetical by author, and a source index indexed to entry number follows the bibliography, beginning on page 43.

NREN Bibliography

1. Adler, Prudence S. Legislative Update: NREN Legislation. ARL: A Bimonthly Newsletter of Research Library Issues and Actions; March 22, 1991; (155): 10-11.
Note: In the "Federal Relations" section.
Adler discusses S.272 and other NREN-related bills. She points out the issues ARL stressed in their letter to Congress, including purposes, access, funding, and governance issues.

2. Adler, Prudence S. NREN-Related Legislation. ARL:a bimonthly newsletter of Research Library Issues and Actions; September 21, 1990; (152).
Note: Adler is Director of Federal Relations and Information Policy for ARL.
THis article reports the passage of the American Technology Preeminence Act of 1990, passed by the House on July 11, 1990. A section of the legislation calls for the development of a 5 year plan to develop the NREN. Jurisdiction concerns remained unresolved with regard to this bill's relationship to both S.1067 and S.1976 which also mandate NREN.

3. Advanced Network and Services, Inc. Formed to Expand National Computer "Superhighway". Information Today; November, 1990; 7(10): 43.
This article describes the establishment of Advanced Network Services, Inc., which was formed by Merit, Inc., IBM, and MCI to manage and operate the NSFNET, which will evolve into NREN.

4. ALA Washington Office Analysis. Committee-Reported NREN Bills: Analysis and Excerpts; June, 1991: 9 pages.
Note: ALA Washington Office. 110 Maryland Avenue, N.E., Washington, DC 20002.
This report provides a summary of the Senate and House Bills under consideration on the High-Performance Computing Act of 1991, which authorizes NREN. The library interest, management issues, administration views, authorization levels, departmental roles, access, fees, and maintenance are reviewed and discussed.

5. Alberico, Ralph. The Development of an "Information Superhighway". Computers in Libraries; January, 1990; 10(1): 33-35; ISSN: 1041-7915.
Note: Alberico is a contributing editor for Computers in Libraries.
Alberico begins by making the point that "it is the ability to communicate knowledge, not store it, that makes libraries more than warehouses." He asserts that what is needed is a network that allows us to deliver as much information as books are able to store. The emergence of networks has made possible new types of scholarly communication and new scholarly communities geographically separated. NREN is

described as a three-way partnership between government, industry and academia. He details the expected phases of development of the NREN. A bibliography of references is included.

6. American Library Association. Washington Office. Legislative Report of the ALA Washington Office; June-December, 1989: 20-21.
This article reports the introduction of S. 1067 and HR 3131. It notes that a similar plan, proposed by D. Alan Bromley, has also been proposed, but with funding to come from agency budgets instead of through separate legislation.

7. American Library Association/Government Documents Round Table Federal Documents Task Force. Somers, Herb and Judith Rowe and Michele Ruhlin. National Research and Education Network and the Federal Depository Library Program: American Library Association/Government Documents Round Table; March, 1991. Note: 9 pages.
This paper discusses the NREN proposal in light of the federal depository library program. It covers existing federal electronic bulletin boards briefly, and speculates on the potential value NREN could have as a means of providing access to government publications.

8. Anthes, Gary H. Gigabit net gets $15M in funds. Computerworld; June 18, 1990: 61.
Anthes reports the cooperative agreement between NSF and DARPA to do research on gigabit networking. The goals of the research are stated, and the development of five testbeds is mentioned.

9. Anthes, Gary. High-performance computing plan offers multiple benefits. Computerworld; April 29, 1991: 100.
Anthes describes a market research report that estimates that the high performance computing program could benefit the economy with a return of of as much as 190 billion.

10. Anthes, Gary H. National Gigabit Net Security Under Fire. Computerworld; Oct. 8, 1990; 24(41): 59,63.
Anthes reports some of the comments critics of NREN proposals have made about security and privacy issues.

11. Anthes, Gary. Network bill in Congress. Computerworld; January 28, 1991: 16.
This article reports the re-introduction of the NREN proposal.

12. Anthes, Gary H. NREN legislation gains new life. Computerworld; October 8, 1990; (41): 8(1).
Note: Anthes is a staff writer for Computerworld.
Reports the compromise reached between rival Senate committees proposing NREN bills.

13. Anthes, Gary H. Rocky road. Computerworld; October 8, 1990: 63.
This articles briefly discusses some of the security issues related to internet and NREN management.

14. Anthes, Gary H. US Budget Shines on High Tech. Computerworld; Feb. 11, 1991; 25(6): 90.
Anthes describes Bush administration support for an increased budget for the National Institute of Standards and Technology for the purposes of working on computer security, computer viruses, and the coordination of vendors and agencies adopting ISDN.

15. Arms, Caroline. Campus Networking Strategies. Bedford, Mass.: Digital Press; 1988.

16. Arms, Caroline. Campus Strategies for Libraries and Electronic Information. Bedford, Mass: Digital Press; 1990; ISBN: 1-55558-036-x.
This book describes developments of campus electronic networks at various sites, including OCLC, RLG, Northwestern, Clemson, Illinois,Brigham Young, Georgia Tech, USC, Columbia, Cornell, Carnegie Mellon, Johns Hopkins, and discusses the context for future developments. NREN is not specifically discussed, although other related networks such as NSFnet are discussed.

17. Arms, Caroline. Libraries and Electronic Information: The Technological Context, Part Two. EDUCOM Review; Fall, 1989; 24(3): 34-43.

18. Arms, Caroline R. A New Information Infrastructure. Online; September, 1990; 14(5): 15-22; ISSN: 0146-5422.
Note: Arms works for the University of Pittsburgh Health Sciences Libraries.
In this paper, the author discusses the changes in information technology during the eighties. She summarizes the developments of bitnet, internet, and other networks, and explains their interconnections, organizationally and technically. The pros and cons of decentralization of networks are examined. The proposal for NREN is also discussed.

19. Arms, Caroline R. Using the National Networks: Bitnet and the Internet. Online; September, 1990: 24-29.
This article does not specifically discuss NREN, but is included because it provides a good introduction to using the existing networks, BITNET and the internet. It covers electronic bulletin boards, locating banks of files, downloading, logging into remote systems, and online catalogs.

20. Association of Research Libraries. ARL, Cause, and EDUCOM announce the Coalition for Networked Information. Washington, DC: ARL; March 16, 1990.
Note: press release, 4 pages.
Citing the need to "full and effective use of emerging networks", ARL, CAUSE, and EDUCOM announced the formation of the Coalition for Networked Information to promote the provision of information resources on existing networks and on proposed networks. Mentions the National Net Conferences sponsored by coalition members, and factors influencing the need for NREN. A list of member institutions is given, as well as a description of the three member organizations.

21. Association of Research Libraries. Linking researchers and resources: the emerging information infrastructure and the NREN proposal. Washington,DC: ARL; 1990.
Note: ARL Briefing package: no. 4.
This is a collection of several articles published in other places, as well as an overview and summary of NREN, a list of players, networks, definitions, and standards.

22. Atkinson, Richard C. and Donald W. Anderson. Wiring the Campuses. Science; May 4, 1990; 248(4955): 529.
Note: Both authors are at UC San Diego, La Jolla, CA.
The challenges that computing technologies present to higher education are discussed. It is argued that computers will become the principal tool for scholarship and that networks are common goods which require central planning and management, preferably by the federal government. Until a national policy is in place the development of campus data networks will be delayed. It is recommended that the NSF should assist campus network installation by providing matching funds.

23. Avram, Henriette D. Copyright in the Electronic Environment. EDUCOM Review; Fall, 1989; 24(3): 31-33.
Note: Avram is at the Library of Congress.
Avram discusses the recommendations of the Library of Congress' Networking Advisory Committee regarding intellectual property issues. Issues mentioned include what is protected and for how long; how infringement is determined; and what tools exist for enforcement. Approaches for dealing with these issues are proposed. NREN is not specifically mentioned, but the issue of copyright in a networked environment is central to this paper.

24. Bell, Gordon C. Gordon Bell calls for a U.S. research network. IEEE Spectrum; February, 1988: 54-57; ISSN: 0018-9235.
Note: Gordon Bell is at Ardent Computer Corp.
Bell contends that existing networks lag behind needs, and are too fragmented. He advocates the development of a national network organized and maintained by the federal government. He believes that such a network would enhance competitiveness, and save money. The TCP/IP standards are helping solve network compatibility problems. He discusses the obstacles to the development of a national network and possible solutions.

25. Bell, Gordon. Steps Toward a National Research Telecommunications Network. Library High Tech; (21): 33-36.
Note: Bell is VP for R & D at Ardent Computer, formerly with NSF.
Bell describes the legislative history of the national research network, and the formation of various key committees devoted to its study and development. He summarizes recommendations made to OSTP, and explains the motivation for the development of a national research network, highlighting its various perceived benefits.

26. Betts, Mitch. Bush tech policy lacks money. Computerworld; September 18 1989,: 121.
Betts reports on Bush administration high-tech policy priorities, but notes that no commitments to funding were included.

27. Betts, Mitch. How technology issues await Congressional action. Computerworld; December 25, 1989: 26.
Betts reports on technology issue before Congress, including NREN.

28. Betts, Mitch. U.S. competitiveness seen in peril. Computerworld; February 12, 1990: 95.
Betts reports the findings of the National Research Council on keeping the U.S. computer industry competitive. Panelists called for NREN support as one means of keeping the U.S. competitive.

29. Bishop, Ann P. The National Research and Education Network (NREN): Promise of New Information Environments. ERIC Digest. Syracuse, NY: ERIC Clearinghouse on Information Resources; Nov., 1990; ED327219. 4p.

30. Bloch, Erich. A National network: Today's reality, tomorrow's vision, Part. 1. EDUCOM Bulletin; Summer/Fall, 1988; 23(3): 11-13.

31. Branscomb, Anne W. Common Law for the Electronic Frontier. Scientific American; September, 1991; 265(33): 154-158.
Note: Branscomb is a communications lawyer at Harvard.

32. Branscomb, Lewis. Planning the New National Network. EDUCOM Review; Spring, 1989.: 7-10.
Note: Branscomb is director of the Science, Technology, and Public Policy program at Harvard.
Branscomb discusses the policy issues related to a national network, including enhancing national productivity, equitable access to the fruits of technological advance, commercial participation, and the responsibilities of various interested parties as he sees them.

33. Breivik, Patricia Senn, and E.Gordon Gee. Information Literacy: Revolution in the Library. New York: Macmillan; 1989.

34. Breivik, Patrick Senn, and Ward Shaw. Libraries Prepare for an Information Age. Educational Record; Winter, 1989; 70(1): 12-19.
Note: Breivik is director of the library at the U. of Colorado Denver. Shaw is Director of the Colorado Alliance of Research Libraries.
This article does not specifically mention NREN, although it does discuss networks. It provides a background for issues libraries face in an electronic age, including the need for interlibrary cooperation, user services, access versus ownership, information literacy, physical plant and budget implications.

35. Brett II, George H. Online Resources: Getting There from Here. Educom Review; Fall, 1990: 48-53.
Note: Brett is an asst. director of educational computing at UNC.
This article discusses online resources for the 90s. It discusses the issues of managing information, how standards might be achieved, how costs can be covered, and how access to all might be assured. Includes a bibliography. NREN is not discussed specifically, although issues of interest to NREN are. A very useful bibliography follows the article.

36. Britten, WIlliam A. BITNET and the Internet: Scholarly networks for librarians. College and Research Libraries News; February, 1990: 103-107.
Note: Britten is Automation Librarian at the University of Tennessee, Knoxville.
Britten reviews some of the existing resources on the internet, and discusses some specifics of using the internet, bitnet. He mentions the NREN proposal. Several listservers addresses are given as well as brief descriptions of them.

37. Brownrigg, Edwin B. The Internet As An External Economy: The Emergence of the Invisible Hand. Library Administration and Management; Spring, 1991; 5(2): 95-97.
Note: Brownrigg is Director of Research, the Memex Research Institute.
Brownrigg looks at the economic aspects of the internet and NREN. He discusses the effect of libraries' interests on the economics of the internet, the evolving market,whether it should be viewed as a public good or a private good, and some of the economic principles behind the "invisible hand".

38. Brownstein, C. US National Research and Education Network. Networks and ISDN Systems; Nov.,1990; 19(3-5): 323-5; ISSN: 0169-7552.
Note: Brownstein is Acting Assistant Director for Computer and Information Science and Engineering at the National Science Foundation.
This is an outline of networking highlights for NSFNET and NREN, including international activities. Graphics of the Proposed Transition from Internet to NREN, Participation and Governance, Proposed NREN Development Plan, and High Speed Network Research Testbeds are all included.

39. Burgess, John. Upgrading Planned for Data 'Superhighway'. Washington Post. Washington, DC; June 13, 1990; A: 20(6).
This article reports the upgrade to 45 megabytes/sec. of NSFNET. Eight sites on NSFNET will be upgraded to this speed.

40. Buxton, Andrew. JANET and the Librarian. Electronic Library; August, 1988; 6(4): 250-63.

41. Carnevale, Mary Lu. Biggest U.S. Computer Research Network Sets up High-Speed Data Link to Europe. Wall Street Journal. New York, NY; March 16, 1990; B: 4(1).

42. Catlett, Charles. The NSFNET: Beginnings of a National Research Internet. Academic Computing; January, 1989; 3(5): 18-21,59-?
Note: Catlett is at the University of Illinois at Urbana-Champaign.
This article provides a history of the development of the NSFNet. It gives details about the various stages of the networks development, the development of regional mid-level networks, some case studies, management and funding issues, the role of MERIT/MCI/IBm in the backbone, the NSFnet as of 1989 and future plans. NREN is not specifically mentioned, but is very much implied.

43. Cerf, Vinton G. Networks. Scientific American; September, 1991; 265(33): 72-81.
Note: Cerf is VP of the Corporation for National Research Initiatives.

44. Cisler, Steve. The Library Community and the National Research and Education Network. Wilson Library Bulletin; June, 1990: 51-55.
Note: Steve Cisler works at the Apple Computer Library.
Cisler briefly reviews the history of network proposals, including the Gore bill. He discusses the data transmission capabilities of the proposed network and the implications for library involvement. He suggests ways that the network might be used, and ways of extending the existing network.

45. Cisler, Steve. NREN: The National Research and Education Network. LITA Newsletter; Spring, 1990; 11, Number 2(40): 1-2; ISSN: 0196-1799.
Describes S. 1067, introduced by Albert Gore, in May, 1989, which proposes that the National Science Foundation and other agencies such as the Departments of Defense, Energy, Commerce, and NASA, develop a national 3 gigabit/second computer network by 1996. This represents "anincrease of 2, 000 times over the current bandwidth.".

46. Cisler, Steve. "NREN: Two Meetings" in "NREN Report, Parts I and II. Public-Access Computer Systems Forum; 1/3/91.
Note: Cisler is at Apple Computer.
This is a report on a symposium held at Harvard University, titled "Information Infrastructure for the 1990s". Cisler provides a summary of the meetings at this symposium, noting that there was little consensus among the participants as to what the information infrastructure should be. Major issues discussed included high-end versus low-end users; the development of technology versus the development of services; the scope of the information infrastructure; and management and organization of the national network.

47. Cline, Nancy. Information Resources and the National Network. Educom Review; Summer, 1990; 25(2): 30-34.
Note: Cline is Dean of Libraries at Penn State.
Cline addresses the policy, management, and technical issues which emerge from the proposal to develop NREN. She highlights areas of development to which librarians can contribute. She sees the possibility of a virtual library on the horizon. She ennumerates the many areas where libraries are already participating in networking, including ordering of materials, interlibrary loan, OCLC, RLIN, bibliographic databases, and the mounting of data files of all kinds. She discusses the potential of a university-based publishing network and the development of a new paradigm of scholarly communication.

48. CNI Task Force Meets in Washington. EDUCOM Review; Summer, 1991: 57,63.
This article briefly reports the CNI meeting of over 260 individuals representing 134 institutions and organizations. Some of the major presentations are briefly summarized.

49. Coalition for the National Research and Education Network. NREN: The National Research and Education Network. Washington, D.C.: Coalition for the National Research and Education Network; 1989.
Note: The Coalition address: 1112 16th Street N.W., Suite 600, Washinton,D.C. 20036.
This is a 15 page glossy publication which describes the network challenge, whom the network will serve, its relation to world markets,and the plans for development and funding of the network.

50. Coalition for Networked Information. Resources Binder. Washington, DC: Coaltion for Networked Information; March 15, 1991.
Note: Unpublished.
This binder contains membership lists, statements of program strategies, vision statements from the working groups, reports of the June, 1990 organizational meeting, reports of the Fall, 1990 meeting of the task force, and agenda materials for the Spring, 1991 meeting.

51. Communications, Computers, and Networks. Scientific American; September, 1991; 265(3): 62-164; ISSN: 0036-8733.
This is a special issue on this subject. Articles in it are also listed separately.

52. Corbin, Roberta A. The Development of the National Research and Education Network. Information Technology and Libraries; September, 1991; 10(3): 212-220; ISSN: 0730-9295.
Note: Corbin is Head of Bibliographic User Services at UCSD.
Corbin traces the development on networks from ARPANET through NREN. She looks at national needs for networking, at govermental roles, legislation, the Coalition for Networked Information, policy issues, and the meaning of NREN for libraries.

53. Cortese, Amy. Internet propels U.S. research. Computerworld; August 14, 1989: 105.
Describes some of the benefits that have already accrued with the internet, such as collaborative efforts on the X Window System, work on VLSI chips, and the Perseus project.

54. Council on Competitiveness. Gaining New Ground: Technology Priorities for America's Future. Washington, DC: Council on Competitiveness; 1991. 77p.

55. DeCandido, Graceanne A. and Michael Rogers. "Virtual Library" Promulgated by Library/Education Coalition. Library Journal; April 15, 1990; 115(7): 14.
This article reports the creation of the Coalition for Networked Information, the collaborative effort of the Association of Research Libraries, CAUSE, and EDUCOM. Some of the focuses of CNI are discussed.

56. Dertouzos, Michael. Building the Information Marketplace. Technology Review; January, 1991: 29-40.

57. Dertouzos, Michael L. Communications, Computers and Networks. Scientific American; September, 1991; 265(33): 62-69.
Note: The author is the director of the Laboratory for Computer Science at M.I.T.

58. Didier, Elain K. A Synergistic Approach to Defining a New Information Environment. Academic Computing; February, 1990: 24-25,38-41.

59. Dougherty, Richard M. An ideal win-win situation: the national electronic highway. American Libraries; February, 1991; 22(2): 182; ISSN: 002-9769.
Note: Dougherty is the ALA President.
Dougherty advocates that librarians take steps to insure that they have input into the development of NREN. He sees it as a tremendous opportunity for librarians to demonstrate the significance of what librarians do. He also sees it as a "democratic imperative" to insure that rural and inner city access to the network becomes a reality.

60. Downes, Robin, ed. Computing, Electronic Publishing and Information Technology: Their Impact on Academic Libraries. Journal of Library Administration; 1988; 9(4).
This entire issue is devoted to computers and electronic publishing. It discusses such topics as the relationship between libraries and computer centers, the relationship between librarians and publishers, issues in using optical disk technology, the education of librarians in an age of information technology, expert systems, and other related issues.

61. Ebbinghouse, Carol. Legislative Update- the demise of NREN legislation for 1990. Research and Education Networking; November/December, 1990; 1(2): 2-3.

62. EDUCOM Networking and Telecommunications Task Force. A National Higher Education Network: issues and Opportunities. Princeton, NJ: EDUCOM; 1987; NTTF Paper no. 1.

63. EDUCOM Networking and Telecommunications Task Force. The National Research and Education Network: A Policy Paper; Revised March, 1990.
This paper outlines the background and goals of NREN as viewed by EDUCOM. It discusses the benefits, network acces and use issues, research and development needs, network services, network management structure, and financing. It calls for a public corporation to take primary responsibility for network management and development. It also calls for open access to the network as an essential element to its success.

64. EDUCOM. Special Issue on Networking. EDUCOM Bulletin; Summer/ Fall, 1988; 23.

65. The Electronic Library. Academe: Bulletin of the American Association of University Professors; July-August, 1989; 75(4): 8-30; ISSN: 0190-2946.
This issue is primarily devoted to the electronic library. Some of the issues discussed include information planning for the electronic library, the escalating cost of scholarly journals, managing bibliographic information with computers, the benefits of library consortia, and budgetary problems of information management.

66. Elsevier Science Publishers. Information on Information. Library Journal; February 1, 1991: 96-97.
Reports the results of a survey that Elsevier did. According to Elsevier, respondents were "not enthusiastic" about computer networks as a means of communication. The survey asked scientific authors how they keep informed, how they communicate, where they submit papers, browsing habits, usage patterns, and other concerns. NREN is not specifically mentioned.

67. Engle, Mary. Library Systems on the Internet. DLA Bulletin; Fall, 1898; 9(2)(20): 1-4; ISSN: 0272-037x.
Note: NREN is not specifically mentioned.
Describes the variety of resources available on library catalogs via internet. It discusses some of the potential problems users may have in accessing these catalogs, such as varying log-on sequences, command languages, uncontrolled vocabularies, equipment incompatibilities, and the lack of user services for remote users. Licensing difficulties for commercially produced databases is another issue touched upon.

68. Executive Office of the President. Office of Science and Technology Policy. A Research and Development Strategy for High Performance Computing. Washington, DC: GPO; November 20, 1987.
Note: Also known as the "FCCSET report".

69. Federal library and Information Center Committee. National Research and Education Network: Special Report 90-2. Washington, DC: Library of Congress; January, 1990.

70. Federal Coordinating Council on Science, Engineering, and Technology. A Report to the Office of Science and Technology Policy on Computer Networks to Support Research in the United States. Washington, DC: FCCSET; November, 1987.

71. Fenly, Judith G. and Beacher Wiggins. The Linked Systems Project: A Networking Tool for Libraries. Dublin, Ohio: OCLC Online Computer Library Center, Inc.; 1988; ISBN: 1-55653-039-0.
This book gives some of the history of early and current efforts at the creation of a nationwide network of library and information services. It gives an overview of the linked systems project, and discusses communications and applications issues. NREN is not specifically mentioned, but the book does provide a background on thinking about library networks.

72. Fernbach, Sidney. A U.S. High Performance Computing Program. International Journal of Supercomputer Applications; Spring, 1990; 4(1): 3-5.

73. Fisher, Sharon. Implementation of NREN is Key to New, Innovative Services. Target Edition No.40(Supplement to Infoworld); December 11, 1989; 11(50): S1-S5.
Note: Fisher is a freelance writer specializing in computer communications.
The past history leading up to NREN is briefly discussed, as well as what services are available, the management of the network, and possible commercial uses of NREN.

74. Fisher, Sharon. Whither NREN? Byte; July, 1991: 181-189.
Note: Fisher is a freelance writer specializing in data communications.
Fisher describes some of the debate over how NREN should be funded, some of the history behind it, the issue of control of the network, and commercialization of the network. She also discusses policing the network, and some possible future scenerios. Sidebars on gaining access to the internet and Senator Gore's views are provided as well.

75. Flanders, Bruce. NREN: The big issues aren't technical. American Libraries; June, 1991; 22(6): 572-574; ISSN: 0002-9769.
Note: Flanders is director of technology at the Kansas State Library.
Flanders argues that the biggest issues involved in NREN are social issues, not technical ones. He cites the information gap it might create between "haves" and have-nots", privacy, intellectual property rights, copyright laws, and First Amendment rights as more significant issues. He urges librarians to follow developments, and to seek ways of providing input on these issues.

76. Foley, John. Networked Designs. Communications Week; April 22, 1991; 348: 1,21,23.
Foley describes some of the applications already being done over networks, including aircraft and automotive design. A sidebar describes the National Center for Supercomputing Applications support for NREN.

77. Frey, Dannalyn, and Rick Adams. !%@:: A Directory of Electronic Mail Addressing and Networks. Newton, Mass.: O'Reilly and Associates; 1989.

78. Gartner Group, Inc. (U.S. Dept. of Energy and Los Alamos National Laboratory). High performance computing and communications: Investment in American competitiveness; 1991. 296p. DOE.

79. Geiger, Karl (USC, University Computing Services, Los Angeles). [Letter to Editor]; October 1, 1988. Datamation. This letter to the editor takes issue with some of the facts presented in Brad Scultz's article, "The Evolution of ARPANET", which appeared in the same journal, August 1, p.71. It attempts to clarify some mistaken assumptions about BITNET and gateway access to it.

80. Getz, Malcolm. Economics: National Research and Education Network. Bottom Line; 1989; 3(4): 32-35.
Note: Getz is Director of Libraries at Vanderbilt University. Getz discusses the potentially dramatic effects NREN will have on libraries. He points out that libraries will be able to access information from across the nation, but also that local users may have less need for the local library since they may be able to bypass it. He discusses the technology of the network in terms of bandwidth needs of various applications, and comments on the relative benefits of different network management policies. Finally, he comments on the importance of libraries providing cost effective service if libraries are to remain relevant to their users, and on some of the changes to which libraries will need to adapt.

81. A giant step towards Internet commercialization? (the evolution of Internet into the National Research and Education Network) (Bulletin). Telecommunications; June, 1991: 7(1).

82. Gilder, George. Into the Telecosm. Harvard Business Review; March/April 1991: 150-161.
Note: Gilder is at the Hudson Institute.
Gilder discusses the stifling effect of telecommunications regulations on business. He discusses computer networks in the context of business' interest, and proposes some changes. NREN is not specifically mentioned.

83. Gore, Al, Jr. The Digitization of schools. (education in the Information Age) (Electronic School supplement). Business Week; Dec.10, 1990: 28 ED; ISSN: 007-7135.
Note: In Special Advertising Section.
The Senator describes the effects of computerization in schools. He describes a recent bill introduced by Senator Kennedy that would establish a National Institute of Technology and Learning. He promotes NREN as an "essential step to a truly national, universal, fiber-optic network.".

84. Gore, Al. Infrastructure for the Global Village. Scientific American; September, 1991; 265(33): 150-153.
Note: Gore is a U.S. Senator from Tennessee.

85. Gore, Al. Networking the Future. Washington Post. Washington, D.C.; July 15, 1990; B: 3.
Senator Gore argues that the United States needs a information highway infrastructure now just as it needed an interstate highway system years ago.He compares the present policy to the old agricultural policies which lead to much wasted food supplies. He agrues that much valuable information goes unused because of a lack of a communication network. He mentions the competitive implications of this network, and some of the political barriers to its implementation. He maintains that it is the proper role of the government to see to its implementation.

86. Gore, Albert, Jr. The information superhighways of tomorrow. Academic Computing; November, 1989; 4(3): 30-31.

87. Gore, Albert. Remarks on the NREN. EDUCOM Review; Summer, 1990: 12-16.
Note: Gore is the chief architect of S.1067, The National High-Performance Computing Act of 1990. This article was a presentation at National Net '90, held March 14-16, 1990 in Washington, D.C.
Gore discusses the concept of an information superhighway; its importance for distributing information resources, linking researchers, competitiveness, and education.

88. The government should work quickly on setting up NREN. Network World: 32.
This editorial calls for Congress and the administration to support the NREN plan. It argues that NREN could provide a real competitive advantage to the U.S. and that it is proper for the federal government to assume responsibility to provide this infrastructure.

89. Hall, Stephen C. The Four Stages of National Research and Education Network Growth. Educom Review; Spring, 1991: 18-25.
Note: Hall is the director of the Office for Information Technology at Harvard.
Hall offers his views on a definition of NREN, its goals and place in the information infrastructure, a framework for understanding its evolution and governance, and a short-term strategy for coordinating its development. He looks at the factors which must be balanced as NREN grows, including finances, applications, resources, users, and management. He predicts that it will take 25 years for the network to reach maturity.

90. Hancock, E.M. The strategic importance of a national network. EDUCOM Bulletin; Summer/Fall, 1988; 23(2/3): 3-7.

91. Hearn, Edward T. and Michael M. Phillips. Supercomputer bill gains in House. Minneapolis Star Tribune. Minneapolis, Minnesota; May 13, 1991; D: 6.
Note: In Government Watch section.
This news article reports the passage of the High Performance Computing Act of 1991 by the Committee on Science, Space, and Technology. The bill increases federal supercomputing funding by $1.9 billion over 5 years.

92. Henderson, Carol C. "Washington Hotline [NREN]". College and Research Libraries News; November, 1989; 50(10): 923-924.

93. Henderson, Carol C. Washington Hotline. C & RL News; March, 1991; 52(3): 176; ISSN: 0099-0086.
Note: Henderson is Deputy Director, ALA Washington Office.
Reports on the reintroduction of Sen. Gore's bill sponsoring NREN. It was reintroduced as S.272 on Jan.24th and as HR 656 in the House. The bills.are not significantly changed, and remain unsatisfactory to the education and library communities.

94. Herbst, Kris. The Dawning of the Age of Network Supercomputing. Supercomputing Review; April, 1991; 4(4): 46-51.
This article details developments in supercomputering networks. It discusses the issues of implementing standards, especially the High-Performance Parallel Interface (HIPPI). The implications and possibilities are discussed, and the developments of high-capacity links are reported. The support for NREN is discussed, particularly as it relates to supercomputer users.

95. Herbst, Kris. SR Interview: D. Allan Bromley, Presidential Science Advisor and head of White House Office of Science and Technology Policy. Supercomputing Review; May, 1991; 4(5): 20-23; ISSN: 1048-6836.
In this interview Bromley discusses the High Performance Computing and Communications Program proposal of OSTP. He says his goal is raise support for supercomputing from the present levels of $500 million to $1 billion/year. He details his differences with Senator Gore over NREN, primarily that it is unrealistic to freeze funding over a five year period because things are changing so quickly. He discusses his philosophy of government support for what he calls "critical generic technologies". He sees a commercial takeover of NREN as the final goal, operating similarly to phone service.

96. Herzog, Kate. Collection Development for the Electronic Library. Computers in Libraries; November, 1990: 9-13.
Note: Herzog is Director at SUNY Buffalo's Science Library.
This article reports on talks given at Cornell University. NREN is discussed as it relates to a vision of the library of the future. Other topics covered include the development of the electronic library, the concept of the SuperBook, changing patterns of scholarly communication, implications of national networks for higher education, and pricing and financing issues related to electronic information resources.

97. Heterick,Robert C., Jr. Networked Information: What Can We Expect and When? CAUSE/EFFECT; Summer, 1990; 13(2): 9-14.
Note: The author is VP for Information Systems at Virginia Polytechnical Institute.
The author looks at the inhibitions to the development of a digital library. He notes that the major impediments are cultural, including economic interests of publishers and copyright law. He suggests what libraries can do to overcome these obstacles, including implementing policies that favor access over acquisition, and ones that favor high-density electronic storage over perpetually expanding library facilities. He discusses the Coalition for Networked Information. He concludes with a statement that libraries will become primariliy access facilitators rather than primarily repositories.

98. High-Capacity Network to Link Researchers Across Country. Data Channels; May 30, 1990: 4-5.
Reviews the NREN proposals, including some of the technical problems that remain to be resolved. It also briefly mentions the implications of the network for the telecommunications infrastructure.

99. Hildebrand, Carol. Hippi means speed for lab users. Computerworld; April 8, 1991: 45.
Note: Hildebrand is a staff writer for CW.
This article describes efforts at the Los Alamos laboratory to define a high performance parallel interface (HIPPI), which they have proposed as a standard to ANSI.

100. Horwitt, Elisabeth. National network prepares for a new speed limit posting. Computerworld; August 21, 1989: 55.
This article reports the migration of NSFNET to full T1 speeds. It describes the switching mechanisms developed to handle higher speed transmissions.

101. Horwitt, Elisabeth. Science to Take the High-Speed Route. Computerworld; Aug. 14, 1989; 23(33): 1,104-1106.
Horwitt reports on the NREN proposal, and some of the problems its development will address.

102. Huray, Paul G. and David B. Nelson. The Federal High-Performance Computing Program. Educom Review; Summer, 1990; 25(2): 17-24.
Note: Huray was chair of FCCSET until Dec.,1989. Nelson has been chair of FCCSET since.
This article provides some history on the various stages of development of government intiatives on high performance computing. The Federal Coordinating Council for Science, Engineering, and Technology (FCCSET) has been central in the process. The history of intiatives, the current status, the budget process, and legislation are discussed. An extended timetable for NREN is suggested. Remaining unresolved issues are also raised.

103. IBM, MCI Form Firm to Aid Research Network. Wall Street Journal. New York, NY; September 19, 1990; B: 4(5).

104. International Business Machines. NSFNET-The National Science Foundation Computer Network for Research and Education; 1990.
Note: 22 pages.
This booklet describes the NSFNET. It gives a history of early networks, including NSFNET. It describes the partnership between MCI, IBM, and Merit Corporation, and goes into detail about the technology that makes the network possible. The management of the network, regional networks, traffic growth on the network, and some of the uses of the network are described in detail. The need and possibility of a commercial national information network is described.

105. Kahn, Robert E. A national network: Today's reality, tommorrow's vision, part 2. EDUCOM Bulletin; Summer/Fall, 1988; 23(2/3): 14-21.

106. Kapor, Mitchell. Civil Liberties in Cyberspace: When does hacking turn from an exercise of civil liberties into crime? Scientific American; September, 1991; 265(33): 158-164.

107. Karraker, Roger. Highways of the Mind. Whole Earth Review; Spring, 1991; (70): 4-11.
Note: Karraker is an instructor in journalism at Santa Rosa Community College.
Karraker looks at the issues of who will build the network, who will have access, who will pay for it, and what kind of information will be transmitted over it. He examines the "interstate highway" metaphor and the "railroad model" metaphors. The social, economic, and political implications of the network are considered. Contains a sidebar that mentions electronic and other sources of information on NREN.

108. Kay, Alan C. Computers, Networks and Education. Scientific American; September, 1991; 265(33): 138-148.
Note: Kay is a fellow at Apple Computer.

109. Kennedy, Kevin. Conference Report: CAUSE89 Interest in Library Issues Evident; Groundwork Laid for ARL, CAUSE, EDUCOM Coalition. Library Hi Tech News; May, 1990; (71): 4,5, 11.
Note: Kennedy is a staff member at CAUSE.
This article reports the CAUSE conference on Campus libraries and information technology. Among the topics discussed were reorganization of campus libraries and computer centers under the same reporting structure, the need for a new type of information professional, and NREN's possible impact on libraries. The Ohio Library Information System was cited as an example of a state-of-the-art system.

110. Kibbey, Mark, and Nancy H. Evans. The Network is the Library. EDUCOM Review; Fall, 1989; 24(3): 15-20.
Note: Both authors are at the Carnegie Mellon Library.
This article offers a vision of the library as a networked environment. It discusses the need for standards, the current status of the electronic library, Project Mercury, economics, and possible future directions.

111. King, Kenneth M. The future of scholarly communication. Occasional Papers, University of Illinois Graduate School of Library and Information Science; Jan.,1991; (no.188-189): 63-75; ISSN: 0276-1769.

112. King, Kenneth M. In Search of a National Computing, Information Access, and Networking Strategy. EDUCOM Bulletin; Fall, 1987: 2-4.
Note: King is President of EDUCOM.
This is an early article which outlines King's vision of networking, which includes a universal campus network that links scholars everywhere to each other, and to information resources worldwide. He calls for an intuitive interface, a global knowledge management system, a highly responsive system, no user charges for basic services, and a study of alternative means of financing computing from a federal level. He also describes what he sees as EDUCOM's role in the network's evolution. NREN is not specifically mentioned, although it is implied, and a World University Network is mentioned.

113. King, Kenneth M. The national network: Where do we go from here? EDUCOM Bulletin; Summer/Fall,1988; 23(2/3): 2.

114. King, Kenneth. Progress in Building a National Information Infrastructure. EDUCOM Review; Summer, 1991: 64,63.
Note: King is EDUCOM's President.
King reports the efforts of the Networking and Telecommunications Task Force and the Coalition for Networked Information. He summarizes some of the key talks given at the CNI spring, 1991 meeting.

115. King, Kenneth. Request for Support of Legislation. Educom Review; Spring, 1991: 11-13.
Note: King is President of EDUCOM.
King shares the letter he sent to the various Senate Committees in this article. He calls for federal investment in the development of NREN. He points out the importance of a partnership of federal, state, and local efforts to develop networking, the educational value of NREN, and the need for all constituencies to have a voice in its development. He outlines the purposes of the network, likely access points, funding needs, and governance of the network.

116. King, Tim. Critical Issues for Providers of Network-Accessible Information. EDUCOM Review; Summer, 1991: 29-33.
Note: King is a VP at John Wiley & Sons.
The author examines publishing in a networked environment. He points out that publishing processes are media independent. He describes four pilot projects that the Association of American Publishers have undertaken, and what has been learned so far from these projects. The major challenges as he sees them are to provide individualization of information access, access in real time, and to provide new ways of working with and presenting information. Copyright, standards, and pricing models are also discussed.

117. Koenig, Michael. The Role of Networks and Consortia in Library Research. McClure, Charles R., editor. Library and Information Science Research: perspectives and strategies. Norwood, NJ: Ablex Publishing Corporation; 1991; c1991: 227-239. (Information Management, policy, and services); ISBN: 0-89391-731-1.
Koenig looks at the stages of information system development, particularly as it relates to the need for research about networks and the role of networks in research. He argues that we are entering the third stage of information systems, which is characterized by exponential growth of computational ability, storage capacity, and communications capability. The development of NREN is seen as raising these issues to greater importance. He discusses the economics of networking, the technological implications of system design, standards, and possibilities for collaborative research which networks offer.

118. Kramer, matt. Whetting the Appetite for bigger bandwidth (The Wide View). PC Week; September 18, 1989; 6: 53(1).

119. Landweber, D.M.,Jennings, and I. Fuchs. Research computer networks and their interconnection. IEEE Communications Magazine; June, 1986: 5-17.

120. LaQuey, Tracy. Networks for Academics. Academic Computing; November, 1989; 4(3): 32-39, 65.

121. LaQuey, Tracy L. User's Directory of Computer Networks. Bedford, Mass.: Digital Press; 1990.

122. Larsen, Ronald L. The Colibratory: The Network as Testbed for a Distributed Electronic Library. Academic Computing; February, 1990; 4(5): 22-23;35-37.
Note: Larsen is Assoc. Director for Information Technology at U Maryland.
Larsen defines "colibratory" as a "collaborative, distributed, experimental scholarly information environment". He sees the NREN as the foundation upon which this may be built. He suggests what might be made available via networks, as well as the issues of functionality, usability, and vertical integration.

123. Learn, Larry L. ISDN, B-ISDN, and SONET: Putting it all together at the speed of light. Library Hi Tech News; October, 1990: 5-8,20.
Note: Learn in director of Technical Planning at OCLC.
This article provides the technical background of the concepts of isdn, b-isdn, and sonet. It details transmission rates, protocol layers, and international variations in the handling of data transmission. In the author's view the upgrade that SONET represents calls into question the need for private networks. He stresses the importance of library professional being aware of the underlying technology upon which NREN will be based.

124. Library of Congress. Network Development and MARC Standards Office. Connecting the Networks: Proceedings of the joint Library of Congress Network Advisory Committee and EDUCOM Meeting; December 5-7, 1988. Washington: Library of Congress; 1989. (v. Network Planning Papers: Number 18).
Note: ISSN: 0160-9742.
This is a collection of papers on national networks. It includes discussions of areas of concern in networking, national networks and higher education, OCLC future functions, access to RLIN via the internet, pilot projects on NYSERNET, the Penn State Library, and working group discussions.

125. Library of Congress. Network Advisory Committee. Intellectual Property Issues in the Library Network Context: Proceedings of the Library of Congress Network Advisory Committee Meeting, March 23-25,1988. Washington: Library of Congress; 1988. 98 p. (Network Planning Papers; Number 17).

126. Lowry, Charles B. Converging Information Technologies: How Will Libraries Adapt? CAUSE/EFFECT; Fall, 1990; 13(3): 35-42.
Note: Lowry is Director of Libraries at U Texas at Arlington.
Although this article only briefly mentions NREN and networks, it provides a larger perspective on the effect of information technologies on libraries. Optical techologies such as CD-ROMs and OMCs (Optical memory cards) are discussed as medium for electronic publishing. Scholarly workstations and electronic books are also discussed, as is the concept of the library as an information laboratory transformed by converging technologies.

127. Lynch, Clifford A. From Telecommunications to Networking: The MELVYL Online Union Catalog and the Development of intercampus Networks at the University of California. Library Hi Tech; 1989; 7(2): 61-83.

128. Lynch, Clifford A. The Growth of Computer Networks: A Status Report. Bulletin of the American Society for Information Science; June/July 1990; 16(5): 10-11.
Note: The author is with the Division of Library Automation, University of California Office of the President.
Summarizes briefly the highlights of networking, including BITNET, ARPANET, NSFNET, and NREN. Discusses policy and management issues.

129. Lynch, Clifford A. Library Automation and the National Research Network. Educom Review; Fall, 1989; 24(3): 21-26.
Note: Lynch is director of Library Automation at the University of California.
Lynch reviews institutional library automation history, with special emphasis on the University of California. Lynch describes how automation has raised expectations of users, particularly for journal literature access and full-text documents. He offers some possible options, including the use of image databases and networks. He addresses the problems of remote log-in on the internet caused by the lack of standards. The problems of networking of cd-roms and the multiple user interfaces required are discussed. The policy issues involved in network resource sharing are also considered.

130. Machovec, Geroge S. National Research and Education Network (NREN). Online Libraries and Microcomputers; October, 1990; 8(10): 1-4; ISSN: 0737-7770.
Note: Author is Head, Library Technology and Systems at Arizona State.
Machovec reviews the legislative proposal of S.1067, Senator Gore's 1989 version of the enabling legislation for NREN. The article includes the text of the ALA resolution on NREN. A bibliography follows.

131. Maloff, Joel H. (CICNet, Inc.). The emergence of the National Research and Education Network (NREN) and its implications for American Telecommunications. Joseph Garodnick, Lynn D. Hutcheson, David A. Kahn, Chairs, editors. Fiber Networking and Telecommunications; 5-8 September, 1989; Boston, Mass. Bellingham, Washington: SPIE-The International Society for Optical Engineering; 1989; c1990: 526-535. (Proc. SPIE; v. 1179); ISBN: 0-8194-0215-x.
Note: Maloff is the Executive Director of CICNet, Inc.,Ann Arbor, Michigan.
This paper looks at the proposed NREN, the need for it, the current state of research and education networks, the FCCSET proposal, network structures, and Senator Gore's proposal, The National High Performance Computer Technology Act of

1989. He also considers obstacles and challenges, as well as benefits and beneficiaries of the proposals.

132. Malone, Thomas W. and John F. Rockart. Computers, Networks and the Corporation. Scientific American; September, 1991; 265(33): 128-136.
Note: The authors are both at M.I.T.

133. Markoff, John. Creating a Giant Computer Highway. New York Times. New York, NY; September 2, 1990; 3: 1(2).

134. Markoff, John. Discussions are Held on Fast Data Network. New York Times. New York, NY; July 16, 1990; D: 2.

135. Markoff, John. For the PC User, vast libraries: and getting the data will be simplified. (development of a nationwide data network). New York Times; July 3, 1991; 140: C1(N), D1(L) col.3.

136. Marsan, Carolyn Duffy. Groups gets funds to upgrade NSFnet: $6 million will help boost eight more nodes to T-3 speed. (National Science Foundation). Federal Computer Week; February 25, 1991; 5(5): 9(1); ISSN: 0893-052x.
This news articles relates that Merit Network Inc., manager of NSFNET, has received an additional $6 million to upgrade 8 more sites to the T-3 speed of 45 megabits/sec., bringing the total number of sites operating at that speed to 16. The future of NSFNET is unclear until funding for NREN is clarified. Merit's contract to manage NSFNET expires in 1992. It is uncertain whether the contract will be renewed at that time.

137. Marshall, Eliot. NSF Opens High-Speed Computer Network. Science; January, 1989: 22-23.
This article describes some of the problems of the NSFNET, including the need for international protocols, the need for a mechanism to do billing and priority routing, and the need for network security.

138. Massey, Walter E. NSF's Role in the National Research and Education Network. EDUCOM Review; Summer, 1991: 34-36.
Note: Massey is director of the National Science Foundation. Massey focuses upon three areas: educational opportunities, information transfer, and research. He sees the role for NSF as being to advance research, and to improve and extend existing facilities. He comments that NSF can be expected to give NREN high priority, that it will consult users widely, and that it will create a National Network Council so that federal, academic, and industry leaders will have input on NREN.

139. McAdams, Alan, Thomas Vietorisz, William Dougan, and James Lombardi. Economic Benefits and Public Support of a National Education and Research Network. EDUCOM Bulletin; Summer/Fall, 1988; 23(2/3): 63-71.
Note: The authors are economists.
This article makes the case that the government should support the development of a national research and education network. It argues that the network would facilitate the development of "new knowledge", which will have economic benefits. It further argues that the network will not develop as rapidly or as completely (if at all) if it is left merely to market forces for its impetus.

140. McCallum, Sally H. Linked Systems Project: Implications for Library Automation and Networking. Advances in Library Automation and Networking; 1987: 1-20.

141. McClure, Charles R., Ann Bishop, and Philip Doty. Electronic Networks, the Research Process, and Scholarly Communications: An Empirical Study with Policy Recommendations for the National Research and Education Network. Syracuse, NY: School of Information Studies, Syracuse University; 1990.

142. McClure, Charles L.; Ann P. Bishop, Philip Doty, and Howard Rosenbaum. National Research and Education Network (NREN): Research and Policy Perspectives. Norwood, NJ: Ablex Publishing Corporation; 1991; ISBN: 0-89391-813-X.
Note: The authors are all associated with the School of Information Studies at Syracuse University.
This book provides an in-depth overview of NREN. It provides background material on NREN current as of February, 1991. The development of NREN, benefits, problems, policy issues, research on networking, user perspectives on electronic networks, and recommendations are all provided. The appendices include the text of several major government documents relating to NREN. This is the most complete single source on information on NREN.

143. McGill, Michael J. Z39.50 Benefits for Designers and Users. EDUCOM Review; Fall, 1989; 24(3): 27-30.
Note: McGill is a VP at OCLC.
McGill suggests that the Z39.5 protocol, an information retrieval protocol, may help overcome some of the barriers for users of information systems. He discusses its background, and its application to OCLC's EPIC service, as well as implications for higher education.

144. Meckler Corporation. Research & Education Networking: the newsletter for Education, Information, and Research Networks; 1990-; ISSN: 1051-4791.
Note: Published 9 times per year.
This entire newsletter may be of interest to those with an interest in NREN. Although not every article deals with NREN, most will be of interest because they treat networking issues. News items, directory information, reports of conferences and workshops on networking, interviews, and articles are all to be found in this newsletter.

145. Mesmer, Ellen. Bush budgets over $600m for high-speed national net: Administration throws weight behind NREN plan. Network World; February 11, 1991: 6.
This article gives some of the specifics of funding level proposals for NREN.

146. Messmer, Ellen. Bush administration, Gore spar over U.S. gigabit net; both debate federal role in net's infrastructure. (National Education and Research Network). Network World; March 11, 1991; 8(10): 6(1).
This article chronicle the debate between the Bush administration and backers of Senator Gore's proposals for high-performance computing. The chief dispute is over the duration of assured funding levels. The Bush administration is unwilling to commit to Gore's five year plan for funding.

147. Messmer, Ellen. National multigigabit net gains support. Network World; February 4, 1919; 8(5): 11.
Note: In Washington Update Section.
Reports the news conference of Senator Gore and Representative Brown in which they urged the President to fund NREN.

148. Molholt, Pat. Libraries and Campus Information: Redrawing the Boundaries. Academic Computing; February, 1990: 20-21, 42-43.

149. Morrison, David C. Technology - Opening an Information Highway. National Journal; November 10, 1990: 2768.
Note: Legislate article no. 119740.
Morrison discusses the NREN proposal in light of other "public works" such as the interstate highway system. The issue of technological competitiveness is mentioned. He also discusses the political difficulties it faces.

150. National Research Council. Computer Science and Technology Board. Keeping the U.S. Computer Industry Competitive: defining the agenda: a colloquim report. Washington, DC: National Academy Press; 1990. 77p.

151. National Research Council. The National Challenge in Computer Science and Technology. Washington, DC: National Academy Press; 1988.

152. National Library of Medicine. National Library of Medicine Long Range Plans Improving Health Professionals Access to Information. Bethesda, MD: U.S. Department of Health and Human Services, NIH; August, 1989.

153. National Science Foundation. NSFNET; 1990.
Note: NSFNET project information is available via ftp from nis.nsf.net.
This booklet outlines the roles of MCI, IBM, and Merit in the NSFNET.

154. National Research Council. National Research Network Review Committee. Toward a National Research Network. Washington, DC: National Academy Press; 1988.

155. National Research Council. Committee on Science, Engineering, and Public Policy. Panel on Information Technology and the Conduct of Research. Information Technology and the Conduct of Research: The User's View. Washington, DC: National Academy Press; 1989. 72p.
This report gives the user's viewpoint on the information technology needs for the future. It presents trends, potentials and problems with information technology. It examines the ways that information technology has changed research methods. It makes several recommendations about developing support policies, services, and standards for information technology. It recommends an interconnected national network as one aspect of meeting the needs of users.

156. National NET '89 [cassette tapes]. Crofton Parkway, Crofton MD: Recorded Resources Corporation; 1989. 21 tapes.
Recorded live at the April 4th and 5th Conference of National Net '89 in Washington, DC at L'Enfant Plaza Hotel.

157. National Net '90: A Strategic Alliance [cassette tapes]. Millersville, MD: Recorded Resources Corporation; 1990.
Recorded cassettes of live talks at March 14-16th Conference in Washington DC, at Loew's L'Enfant Plaza.
Note: 15 tapes.
Includes all talks at National Net '90 Conference, covering the keynote speech by Senator Gore, talks on information resources, managing a network,NREN research and devlopment, legal and regulatory issues,electronic publishing and the NREN, the role of mid-level networks, industry viewpoints, NREN's future, educational applications, engineering the NREN, intellectual property rights, and legislative activities.

158. National Net '91 [cassette Tapes]. Millersville, MD: Record Resources Corporation; 1991. 17 tapes.
Tapes of the 1991 National Net Conference, held in Washington, DC.

159. The National Network: Views from Government, Industry, and Academia. EDUCOM Review; Summer,1989; 24(2).
Note: Issue topic.

160. Negroponte, Nicholas P. Products and Services for Computer Networks. Scientific American; September, 1991; 265(33): 106-113.
Note: Negroponte is director of M.I.T.'s Media Laboratory.

161. Nelson, Milo. Trying on Renaissance Clothes: EDUCOM '90 Meets in Atlanta. Information Today. Medford, NJ; December, 1990: 31-33.
This article summarizes presentations given at the EDUCOM meetings on October 14-17.

162. Nelson, Nancy Melin. Conferences, NREN, and OCLC. Information Today; September, 1990.
This article briefly mentions NREN as a program topic at the ALA conference.

163. Nicholson, Paul. National Research Network Advocated in Congressional Testimony. Telecommunications; January, 1990; 24: 49-.

164. Nielsen, Brian. Finding it on the Internet: The Next Challenge for Librarianship. Database; October, 1990: 105-107.
Note: Nielsen is at Northwestern University Library.
Nielsen discusses how to make the "National Internet" a usable tool. He points out difficulties in using it in its present form, describes some of the type of materials on the internet, such as online catalogs, databases, and electronic journals, and addresses the issues of cataloging of electronic information. He suggests that it is important to begin to develop a database of resources on the internet.

165. NREN, electronic library systems and information services are topics at CNI meeting. C & RL News; June, 1991; 52(6): 384-386.
Summarizes presentations given at the Spring, 1991 meeting of the Coalition for Networked Information.

166. O'Connor, Rory J., Computing Editor. Network of dreams: Build it, and hardware, software will come. San Jose Mercury News. San Jose, CA; February 10, 1991; F: 1.
Note: In "Computer Trends" section.
This article reports the proposed NREN. It discusses the speeds proposed and some of the problems it may help solve.

167. Office of Science and Technology Policy. A Research and Development Strategy for High Performance Computing. Washington, DC: GPO; November 20, 1987.
Note: See V1#11 for reference to .

168. Office of Science and Technology Policy. Federal Coordinating Council for Science, Engineering, and Technology. Committee on Physical, Mathematical, and Engineering Sciences. Grand Challenges: High Performance Computing and Communications. Washington, DC: Executive Office of the President. Office of Science and Technology Policy.; 1991.
Note: The FY 1992 U.S. Research and Development Program. 57p.
This booklet describes a coordinated research and development program in advanced computing and networking. It details program goals, the components of a high performance computing and communications program, agency budgets and program development, and several examples of what types of research the program will facilitate. Examples of NREN applications are given and NREN's place in the larger context of high performance computing is explained.

169. Okerson, Ann. Scholarly Pubishing in the NREN. ARL:A Bimonthly Newsletter of Research Library Issues and Actions; July 4, 1990; (151): 1-4.
Note: Okerson is Director of the ARL Office of Scientific and Academic Publishing.
Okerson argues that publishing should be the "most important activity developed on the network". She discusses incentives that support this assertion. She proposes what the Coalition for Networked Information should do to build scholarly publishing into the network.

170. OTA Reports on Supercomputer Role in Addressing Global Problems and Maintaining U.S. Pre-eminence in Science and Technology. Bulletin of the American Society for Information Science; April/May, 1991; 17(4): 2; ISSN: 0095-4403.
Note: Newsfront section.
This news article summarizes OTA findings about high performance computing needs. It emphasizes the need for intra-agency cooperation in the development of NREN, the need to balance security with equitable access, and the need to address software, user services, and user education needs.

171. Palca, Joseph. Getting Together Bit by Bit. Science; 13 April 1990; 248: 160-162.
Discusses likely developments of high-speed digital networks. Recent NSFNET use patterns are described. The types of applications that might be possible are described and the technical problems discussed. Some of the history of electronic networks is discussed. NREN is briefly mentioned.

172. Parkhurst, Carol A., editor. Library Perspectives on NREN: the National Research and Education Network. Chicago: Library and Information Technology Association.; 1990; ISBN: 0-8389-7477-5.
Note: Papers largely from 1990 ALA Summer Conference in Chicago.
This book pulls together papers presented at the ALA Annual Conference. It includes a chronology on NREN legislation; the LITA President's Program; papers on "Visions of a National Network"; discussion papers; a bibliography and glossary.

173. Peters, Paul Evan. CNI Task Force Meeting Report. ARL:a bimonthly newsletter of research library issues and actions; May 8, 1991; (156): 6.
Note: Peters is the Director of the Coalition for Networked Information.
This article reports on the Spring, 1991 meeting of CNI held in Washington, DC, March 18-20. He describes talks on lessons from the Corporation for Public Broadcasting and COMSAT, a vision statement on the electronic library system scenario, the user's perspective.

174. Peters, Paul Evan. Coalition on Networked Information. ARL:a bimonthly newsletter of research library issues and actions; September 21, 1990; (152): 6.
This article reports on CNI membership, which has grown to over 100 institutions and organizations. A schedule of planned CNI presentations is also given, as well as other upcoming work of the coalition.

175. Peters, Paul. Lessons from the CNI. Educom Review; Spring, 1991: 8-9.
Note: Peters is director of the Coalition for Networked Information.
Peters reflects upon the first year of the Coalition for Networked Information. He says that the coalition grew at a rate beyond expectations, to over 120 organizations. He concludes that partnerships between various interested parties such as Educom, Cause, and ARL are essential to the success of NREN, as are partnerships between government, industry, and educational institutions. He also concludes that coordination between the educational and research communities will lead to greater benefits for each, rather than having each develop networks independently.

176. Peters, Paul Evan. Network Coalition Formed: ARL/ EDUCOM/ CAUSE. ARL: A bimonthly newsletter of Research Library Issues and Actions; May 4, 1990; 143: 1.
This article reports the formation of the Coalition for Networked Information. The coalition is a result of efforts of the ARL Telecommunications Task Force, the ARL Federal Relations Officer, and officers of CAUSE and EDUCOM. At the time of its formation, 58 institutions and organizations made a commitment to join it.

177. Peters, Paul Evan. Networked Information Resources and Services: Next Steps. CAUSE/EFFECT; Summer, 1991; 14(2): 27-39.
Peters examines the advantages that NREN promises, specifically simplification, connectivity, and performance. He notes that as of March 31, 1991, there were 2,501 networks connected to NSFNET, including 757 foreign networks. He estimates that 200,000 computers and 10 million users may have access. He describes networked information resources, such as electronic journals, library catalogs, and high-volume print facilities. He suggests that libraries may benefit from NREN by needing less space to expand, and possibliy by self-publishing efforts. He also mentions what needs to be done to get ready to benefit from NREN.

178. Peterson, L.; Hutchinson, N.; et. al. The x-kernel: a platform for accessing internet resources. Computer; May, 1990; 23(5): 23-33; ISSN: 0018-9162.

179. Public and Private Initiatives to Create a National Education and Research Network. EDUCOM Bulletin; 1988; 23(2/3).
Note: Proceedings of National NET '88 Conference.

180. Quartermain, John. The Matrix: Computer Networks and Conferencing Systems Worldwide. Bedford, MA: Digital Press; 1990.

181. Quartermain, John S. and Josiah C. Hoskins. Notable Computer Networks. Communications of the ACM; Oct., 1986; 29(10): 932-971.
This article does not specifically mention NREN. It does, however, give an extensive background of research networks, including government networks, company networks, and cooperative networks. It also examines social, legal, administrative, and financial issues in networking.

182. Reich, Vicky. Conference Report: Coalition for Networked Information: "The Pricing Crisis, Setting a CNI Agenda". Library Hi Tech News; May, 1991; 81: 1-2.
Note: Reich is chief, serials and acquisitions at Standford. This article summarizes a meeting of invited members of the Coalition for Networked Information. Issues discussed include the need for a new economic model for scholarly publishing, pricing issues, and comments by editors of electronic journals on how their journals are used.

183. Reynolds, Dennis J., editor. Citizen Rights and Access to Electronic Information: a collection of background essays prepared for the 1991 LITA President's Program. Chicago, IL: Library and Information Technology Association; 1991.
Note: Papers from the LITA President's Program at 1991 ALA Annual Conference.
This brief book covers the issues of constitutional rights as they relate to the emerging electronic environment. The issues, their impact, a legislative update, and position papers are included. NREN is mentioned specifically in several of the papers, and the issues presented in general will be ones NREN will bring to the fore.

184. Richards, Evelyn. Bush to Unveil High-Tech Initiative. Washington Post. Washington, DC; September 7, 1989; A: 18.
This article describes the administration version of NREN.

185. Richards, Evelyn. Computer Plan a Boost for Companies. Washington Post. Washington, DC; September 10, 1989; H: 3.
The author reports on some reactions to the Bush NREN proposal from corporate officers, who generally welcome the proposal.

186. Roberts, Michael M. The Global Internet and the NREN. Educom Review; Winter, 1990: 8-9.
Note: Roberts is VP for networking at EDUCOM.
Roberts discusses the Interop Conference which he views as a turning point in the attitude of the networking community towards a recognition of the globalization of the American Internet. There are now 2,063 networks currently connected to NSFNET, over 500 of which are outside the United States. One goal of NREN, that of connectivity, is being achieved. The adoption of the TCP / IP protocol as a de facto standard is hastening the progress of networking.

187. Roberts, Michael M. Implementing the NREN - the Prologue Is Over. EDUCOM Review; Fall, 1990; 25(3): 9-10.
Discusses the priorities in the implementation of NREN, connectivity issues, funding issues, services and planning. He points out the need for campus networks to adopt the TCP/IP protocol as a standard if wide-spread interconnection is to be achieved. He discusses different models of funding for NREN, and stresses the need for planning and widespread involvement now by government, university administrators, network managers, and others.

188. Roberts, Michael M. The NREN and Commercial Services. EDUCOM Review; 1990?: 10-11.
Note: Author is VP for Networking at EDUCOM and Director of the Networking and Telecommunications Task Force and the BITNET Network Information Center.
Roberts contends that one of the most important issues relating to the NREN is that of the appropriate place of commerical services. Some government officials fear that NREN may be a permanent part of the the public-sector infrastructure, and that it would diminish the future of communications markets. He points out that NREN itself will not be the advanced communication infrastructure, but that it may be a prototype of such an infrastructure. He suggests that NREN will not have a significant economic impact, but that it may bring into relief many unresolved issues of taxation and legalities. He believes a balance between commercial interests and the interests of researchers will be reached.

189. Roberts, Michael M. Positioning the National Research and Education Network. EDUCOM Review; Summer, 1991: 11-13.
Roberts discusses recent Congressional proposals on the development of a fiber-optics network infrastructure. He raises the question of the inter-relationship between new proposal and NREN. Are they in competition? In his view NREN will be an important part of the evolution to the NII, the National Information Infrastructure. NREN could provide the research, development, and technology transfer needed to create the NII. NREN could be the prototype for a broader NII.

190. Roberts, Michael M. Shaping the National Network. EDUCOM Review; Summer, 1989: 11-13.
Note: Roberts is VP for Networking at Educom.
Roberts outlines three stages for development of the NREN: (1) Convincing policy makers of the importance of the idea; (2) describing and defining the network to the satisfaction of the networking community; and (3) implementing the network. He suggests that the first stage is essentially complete. The second is "perhaps half finished". The implementation stage depends upon the passage of Senator Gore's bill.

191. Rogers, Sharon and Charlene Hurt. How Scholarly Communication Should Work in the 21st Century. Chronicle of Higher Education; October 18, 1989: A56.
Note: Rogers is University Librarian at George Washington U. Hurt is Director of Libraries at George Mason U.
This article does not specifically mention NREN. It does, however, discuss the concept of a national network, one for the sharing of scholarly journals electronically. A proposed new system of scholarly communication is offered, one based upon a network funded by particpants and grants. It is suggested that it would provide a cost-effective alternative

to the existing print distribution system, and one that would assure quality control.

192. Rogers, Susan M. Educational Applications of the NREN. EDUCOM Review; Summer, 1990; 25(2): 25-29; ISSN: 1045-9146.
Note: Rogers is involved with distance learning at R.I.T. The author contends that the educational aspects of NREN are in danger of being overlooked. She believes that NREN presents an opportunity for significant instructional applications, as in distance education, in working with students with disabilities, and in connecting students, teachers and information resources. She gives examples of uses at R.I.T. For NREN to be successful, she feels, it must be reliable, accessible, versatile, and reasonable.

193. Rosenberg, Ronald. NSF Funds Research for Speedier Computer. Boston Globe. Boston, MA; June 9, 1990: 12(5).

194. Runnoe, Gail. Congress backs nat'l net, wants broader overhaul. Network World; October 16, 1989: 23.
This article discusses criticisms of the NREN proposals. Although generally supportive of the concept, some House Telecommunications and Finance Subcommittee members feel that a broader overhaul of the nation's public telecommunication network is needed if equitable access to all is to be provided.

195. Ryland, Jane. In search of a universal library. Computerworld; July 23, 1990: 21.
Ryland briefly describes a vision of a virtual library where all publications are captured, organized, indexed, and stored on magnetic or optical disc. She also mentions the formation of the Coalition for Networked Information, and the NREN proposal. She calls for efforts to bring business and industry, especially publishers into discussions of the virtual library.

196. Savage, J.A. adn Gary Anthes. Casting a wide-reaching Internet. Computerworld; November 26, 1990: 12.
The authors briefly describe the extent of the internet, its principal backbones, funding sources, commercial gateway services, and the NREN proposal.

197. Savage, J.A. and Gary H. Anthes. Internet privatization adrift. Computerworld; November 26, 1990: 1.
This article discusses the issues of making internet and NREN a private network, including what types of services might eventually be on it, how services will be provided, and some of the unresolved issues.

198. Scholarly Communication in the 1990s. Information Technology Quarterly; Spring, 1990.
Note: Special issue on this subject.

199. Schultz, Brad. The Evolution of ARPANET. Datamation; August 1, 1988: 71-74.
Note: Schultz is a freelance writer based in New York City. This article describes the transition from ARPANET to the internet. It gives a history of the development of the TCP/IP protocol, and its effects on inter-network communications. NREN is not specifically mentioned.

200. Seiler, Lauren H. The Future of the Scholarly Journal. Academic Computing; September, 1989: 14-16,66-69.
NREN is not specifically mentioned in this article, athough the possibility of electronic journals is discussed in some detail. The electronic library is discussed, and the types of changes scholarship will need to undergo are detailed. The issues of rigor, integrity of data, centralization of databases, and costs are covered.

201. Sexton, Mark. ALA's Midwinter Meeting: Not Just for Children's Books. Publishers Weekly; February 22, 1991; 238(10): 113-114.

202. Society for Industrial and Applied Mathematics. A National Computing Initiative, the agenda for leadership. Philadelphia: Society for Industrial and Applied Mathematics; 1987.

203. Sproull, Lee and Sara Kiesler. Computers, Networks, and Work. Scientific American; September, 1991; 265(33): 116-123.
Note: The authors are social scientists, at Boston U and Carnegie Mellon, respectively.

204. Stevens, Norman. Library Perspectives on NREN. Wilson Library Bulletin; Feb., 1991; 65: 126(1); ISSN: 0043-5651.

205. Sugnet, Chris. Networking in Transition: Current and Future Issues. Library Hi Tech; 1988; 6: 101-119.
Note: Sugnet is at University of Arizona Library.
This is a forum of several short articles on library networks, which address such issues as their history, threats to networks, and coping with the changes they require.

206. Tesler, Lawrence G. Networked Computing in the 1990s. Scientific American; September, 1991; 265(33): 86-93.
Note: Tesler is VP for advanced products at Apple Computer.

207. Turner, Judith Axler. New Company Formed to Sell Access to Computer Networks for Research. Chronicle of Higher Education; February 7, 1990; 36(21): A22.

208. Turner, Judith Axler. Office of Technology Assessment Backs National Computer Network. Chronicle of Higher Education; November 1, 1989; 36: A18.

209. Turner, Judith Axler. Pentagon Transfers Computer Resources, Technologies to National Science Foundation. Chronicle of Higher Education; June 14, 1989: A5.

210. Turner, Judith Axler. U.S. Agencies Plan to Speed Up and Expand National Comptuer Network for Researchers. Chronicle of Higher Education; June 20, 1990; 36(40): A20,A29.

211. U.S. Executive Office of the President, Office of Science and Technology Policy. The Federal High Performance Computing Program. Washington, DC: OSTP; September 8, 1989.
Describes the goals and strategy for the (HPC) high performance computing program. Discusses NREN in the context of HPC.

212. United States. Congress. House. American Technology Preeminence Act of 1990. Washington, DC: GPO; H.R. 4329.

213. United States. Congress. Senate. Subcommittee on Science Technology and Space. Computer Networks and High Performance Computing: Hearings before the Subcommittee on Science, Technology, and Space. Washington, DC: GPO; August 11, 1988; SuDoc No. Y4.C73/7:S hrg. 100-947. 146p.
This document contains statements by Senators Gore, Riegle, and Hollings. Witness testimony from 9 witnesses is included, as well as two articles, and a statement from the Deputy Director of OSTP, Dr. Thomas P. Rona. Witnesses include, among others, Kenneth King, Robert Kahn, and William Wulf.

214. United States. Congress. Senate. Committee on Energy and Natural Resources. Department of Energy High-Performance Computing Act of 1990. Washington, DC: GPO; 1990; Y 1.1/5-101-377. 27p.

215. United States. Congress. Senate. Committee on Energy and Natural Resources. Subcommittee on Energy Research and Development. Department of Energy High-Performance Computing Act of 1989: hearing before the Subcommittee on Energy Research and Development of the Committee on Energy and Natural Resources. Washington, DC: GPO; March 6, 1990; S. hrg. ; 101-613. 210p.
Note: Y 4.En 2:S.hrg. 101-613.
Contains opening statements , the text of S. 1976 and witness statements from 11 witnesses and congressmen.

216. United States. Congress. Senate. Committee on Energy and Natural Resources. Department of Energy High Performance Computing Act of 1991. Washington, DC: GPO; April 11, 1991; Y 4.En 2-S.hrg. 102-60. 84p.

217. United States. Congress. Office of Technology Assessment. High Performance Computing and Networking for Science-Background Paper. Washington, DC: U.S. Government Printing Office; September, 1989; OTA-BP-CIT-59.
Note: GPO stock # 052-003-001164-6. LCCN: 89-600758.
This background paper looks at research and information technology as it may become in the future. It examines major issues and problems,and the economic and scientific importance of information technology. High performance computers are discussed, as are networks. One chapter is devoted to NREN specifically, including a discussion of the present NREN, the players in the NREN, policy issues, financing, and management of the network. Includes figures and tables.

218. United States. Congress. Office of Technology Assessment. Informing the Nation: Federal Information Dissemination in an Electronic Age. Washington,DC: GPO; 1988; OTA-CIT-396.
This book provides a background of the federal government's view of the effects of an electronic age on government information dissemination. It covers the GPO, NTIS, Depository Libraries, electronic publishing, online information dissemination, the electronic dissemination of congressional information, the Freedom of Information Act, electronic press releases, and proposes policies and alternative scenerios for coping with the electronic age. It provides a background against which NREN can be better understood.

219. United States. Congress. Senate. Committee on Energy and Natural Resources. National High-Performance Computing and Networking Act. Washington, DC: GPO; May, 23, 1991; S. Rept. 102-64.
This is the Energy Committee's version of High-Performance Computing legislation. It reports on S.343.

220. United States. Congress. Senate. National High-Performance Computer Technology Act. Washington, DC: GPO; May 18, 1989; SuDoc No. Y1.4/1:101-140 F14+.

221. United States. Executive Office of the President. Office of Science and Technology Policy. White House Science Council Committee on Research in Very High Performance Computing. Research in Very High Performance Computing: Policy Recommendation and Research Requirements Statement. Washington, DC: OSTP; November, 1985; PB86-209723. 31p. NTIS.
This report discusses the future of very high performance (VHP)computing in the United States. The report found that VHP is essential to national security, economic competitiveness, and knowledge acquisition. It recommends that university-industry-government programs be developed to accelerate VHP developments. It specifies areas where research is needed.

222. United States. Congress. Office of Technology Assessment. Seeking Solutions: High-Performance Computing for Science-Background Paper. Washington, DC: GPO; April, 1991; OTA-BP-TCT-77.
Note: Y 3.T 22/2:2 Sci 2/3.
This paper describes the information infrastructure for high-performance computing. It describes the goals of the initiative, the current federal situation, strategic concerns, long-range planning needs, policy considerations, difficulties and barriers, the role of computers in research and development, the evolution of computer technology, and gives examples of some of the problems that may be solved by high-performance computers.

223. United States. Congress. Senate. Committee on Commerce, Science, and Transporation. Subcommittee on Science, Technology, and Space. Computer networks and high performance computing: hearing before the Subcommittee on Science, Technology, and Space of the Committee on Commerce, Science, and Transporation. Washington, DC: GPO; 1988; S. hrg. ; 100-947.
Note: Y. 4.C 73/7:S.hrg.100-947.

224. United States. Congress. Senate. Committee on Commerce, Science, and Transportation. High-Performance Computing Act of 1990: report of the Senate Committee on Commerce, Science, and Transporation on S. 1067. Washington, DC: GPO; July 1990; S.Report 101-387.

225. United States. Congress. Senate. Committee on Commerce, Science, and Transportation. Subcommittee on Science, Technology, and Space. High-Performance Computing and Communications Act of 1991: hearing before the Subcommittee on Science, Technology, and Space. Washington, DC: GPO; March 5, 1991; S. hrg. ;102-23.
This contains opening statements by Senators Gore, Pressler, Kasten, Hollings, and Robb, followed by the test of S.272. Witnesses include Allan D. Bromley, Tracey Gray, Malvin Kalos, Donald Langenberg, Dave Nael, and John Wold. Additional statements from ALA, ARL, EDUCOM, and others are included.

226. United States. Congress. Senate. Committee on Commerce, Science, and Transportation. High-Performance Computing Act of 1991. Washington, DC: GPO; S.Rept. 102-57.
This is the Senate report on S. 272, Senator Gore's version on the HPC bill.

227. United States. Congress. Senate. Committee on Commerce, Science, and Transportation. Subcommittee on Science, Technology, and Space. National High-Performance Computer Technology Act of 1989. Hearings before the Subcommittee on Science, Technology, and Space of the Committee on Commerce, Science, and Transportation.; June 21, July 26, and September 15, 1989; S.Hrg 101-638. 413p.
This includes the hearings on the three dates listed above. Each hearing is preceded by opening statements from Senators, followed by statements from witnesses, and two additional statements, including one from the Association of American Publishers. Ted Nelson is among the several witnesses, speaking on hypertext.

228. United States. Congress. House. Committee on Science, Space, and Technology. Subcommittee on Science, Research, and Technology. H.R. 3131, the National High-Performance Computing Technology Act: hearing before the Subcommittee on Science, Research, and Technology of the Committee on Science, Space, and Technology. Washington, DC: GPO; March 14, 15, 1990; GPO Item number: 1025-A-1, 1025-A-2 (MF).
Note: Y 4.Sci 2:101/115.
Includes opening statements and witness statements from 14 witnesses, plus additional statements including one from the Librarian of Congress.

229. United States. Congress. House. Committee on Science, Space, and Technology Subcommittee on Science Research and Technology. High performance Computing: hearing before the Subcommittee on Science, Research, and Technology of the Committee on Science, Space, and Technology. Washington, DC: GPO; October 3, 1989; Y 4.Sci 2-101/64. 173p.
Note: Y 4.Sci 2:101/64.
Includes minutes, opening statements, and witness testimony from witnesses such as Dr.D.Alan Bromley, Dr. William Wulf, Dr. Joseph Traub, J. Gary Augustson, Dr. Robert Lucky, Dr. Richard Mandelbaum, Dr. Sushil Munshi, and an additional statement by Burton J. Smith.

230. United States. Congress. House. Committee on Science, Space, and Technology. High-Performance Computing Act of 1991. Washington, DC: GPO; May 15, 1991; H. Rept. 102-66 on HR 656.
Note: In two parts.
This report is the study made on H.R. 656. It gives the background and need for legislation, committee actions, amendments, committee views, a legislative history, and other studies on the proposed bill.

231. Updegrove, Daniel A.,John A. Muffo, and John A. Dunn,Jr. Electronic Mail and Networks: New Tools for University Administrators. EDUCOM Review; Spring, 1990: 21-28.
Note: Also published in CAUSE/EFFECT and as AIR Professional File.
This articles discusses how to get connected to networks, costs, and how to use networks. It is targeted towards new users and well as those with some experience. It covers what electronic mail is, how it works, what networks exist, how administrators use e-mail, and mentions NREN briefly. It is especially useful for its sidebar lists of networks, libraries, listservers, and command summaries.

232. Updegrove, Daniel, Jahn A. Muffo, and John A. Dunn. Electronic Mail and Networks: New Tools for University Administrators. EDUCOM Review; Spring, 1990; 2(1).

233. Urge National Computer Research Network. Research Technology Management; Nov.-Dec.,1988; 31: 5-.

234. Valovic, Thomas S. Conflict or cooperation? NREN and US telecom policy (National Research and Education Network). Whole Earth Review; Spring, 1991: 12(3); ISSN: 0749-5056.
Note: Valovic is senior editor of Telecommunications magazine.
Valovic discusses the policy-making agencies affecting U.S. telecommunications policies. While the implementation of the NREN is unlikely to require telecommunications policy decisions, the expansion of it to truly be an "information infrastructure" will require policy decisions. He surveys the fractionalized state of U.S. telecom policy and suggests that NREN as an issue might be a means to reinvigorate telecom policy discussions. In the larger context of telecommunications in the U.S., NREN may be viewed as yet another competitor. He advocates that NREN be placed on the national telecom policy agency so that the full range of needs and services can be considered.

235. Valovic, Thomas S. The NREN enigma: a new national network? (National Research and Education Network). Telecommunications; January, 1991; 25: 13(2).

236. Van Houweling, Douglas E. The National Network: A National Interest. EDUCOM Review; Summer, 1989; 24(2): 14-18.
Note: The author is VP for Information Technology at Univ. Michigan.
The demographic trends of American society are discussed as they relate to our national need for educated researchers. It is argued that our entire educational system would benefit from more rapid access to information. NREN is seen as the means to provide this rapid access by researchers to other scholars, to scientific instruments, to computers, and to libraries. A broad bandwidth is called for, as is powerful connectivity. NSFNET and future resources are discussed, and

a call is made for a nonprofit corporation to manage the network.

237. Walgren, Douglas. Towards a higher education network. EDUCOM Bulletin; Summer/Fall, 1988; 23(2/3): 8-10.

238. Walsh, John. Designs on a National Research Network. Science; February 19, 1988; 239: 861.
This article details early proposals and arguments for the implementation of a national network for research. It discusses NSF-NASA plans for interconnectivity. It reports on the problems encountered by users of the networks, notably transmission speeds.

239. Watkins, Beverly T. National Computer Network's Success Said to Require New Collaboration. Chronicle of Higher Education; June 5, 1991; XXXVII(38): A14.
Describes some of the ideas discussed in Charles McClure's new book on NREN. One priniciple issue seems to be the lack of communication between the network engineers, and the end-users. At present there is little effective communication between these groups, according to McClure.

240. Watkins, Beverly T. New Group to Promote Internet's Role in Global Computer Networking. Chronicle of Higher Education; September 11, 1991: A25.
Reports on the formation of a new society, The Internet Society. The society's organizers include the Corporation for National Research Initiatives, EDUCOM, and the Internet Activities Board.

241. Watkins, Beverly T. Proponents of High-Speed Network Urged to Stress Economic Benefits. Chronicle of Higher Education; April 3, 1991; 37(29): A20.

242. Weber, Robert. The Clouded Future of Electronic Publishing. Publishers Weekly; June 29, 1990: 76-80.
Note: Weber is with Harvard's Office for Information Technology.
Weber speculates on likely developments in electronic publishing. He discusses constraints upon the development of electronic publishing, the rewiring of America, the commercialization fo the Internet as NREN, the issue of agreement on standards, the need for quality displays, the issue of enforcing copyright and other potential problems. He concludes that the chief problems are political not technical problems.

243. Weber, Robert. Copyright in the Electronic Age. Publishers Weekly; March 22, 1991: 52-53.
Note: Weber is at Northeast Consulting Resources in Boston.
Weber examines the potential problems that may be raised as more information is available in electronic formats. He discusses efforts to establish rules of access, the advantages of a fixed-fee approach, some new database projects underway, and the issue of how restrictive copyright laws should be to achieve a balance between the needs of rights holders and users. NREN is not specifically mentioned, although the idea of access to databases over national networks is mentioned.

244. Webster, Duane. Proposal for an ARL/CAUSE/EDUCOM Coalition. Association of Research Libraires: ARL; February 9, 1990.
Note: 8 pages.
This paper describes the proposal for the formation of the Coaltiion for Networked Information, a coalition of EDUCOM, CAUSE, and ARL, formed to examine issues relating to NREN. The goals of NREN are stated, campus networking developments are discussed and task ahead are identified. These tasks include examination of issues relating to intellectual property rights, standards, licensing, service arrangements, cost recovery, and economic models for NREN. Managment of CNI, its funding and budget, and activities of member organizations are also discussed.

245. Weingarten, Fred. Five Steps to NREN Enlightenment. EDUCOM Review; Spring, 1991: 26-30.
Note: Weingarten is executive director of the Computing Research Association.
Describes the conflicting views in the articulation of the vision of NREN. He describes the "true NREN vision" as a network serving everyone, but through intermediary public institutions, such as schools, universities, libraries, and museums. He also describes the flow of technological innovation, ways of justifying action politically, means of action, and defining constituency for NREN. He concludes that a balance must be reached between the desire to make NREN universally available and the needs of various science agencies for NREN. He also believes that it is important for the end-user participation in the development stage if NREN is to be universally useful.

246. Weiser, Mark. The Computer for the 21st Century. Scientific American; September, 1991; 265(33): 94-104.
Note: Weiser is the Xerox Palo Alto Research Center.

247. West, Richard P. NREN Issues: Funding, Equity, Innovation. ARL: Bimonthly Newsletter of Research Library Issues and Actions; March 22, 1991; (155): 1-3.
Note: West is Chair, Coalition for Networked Information.
West discusses three core issues that should be addressed: how the network should be funded and governed; how to stimulate innovations; and how to assure equitable access.

248. Whitmore, Stan. If IBM's money could change the world... PC Week; April 22, 1991; 8: 61(1).
Note: (editorial).

249. Wintsch, Susan. Toward a National Research and Education Network. MOSAIC; Winter, 1989; 20(4): 32-42.

250. Witherspoon, John P. Planning Models for National Research and Education Network Development. EDUCOM Review; Summer, 1991: 20-24.
Note: The author is a professor of telecommunications and film at SDSU.
Witherspoon addresses the issues of how to make NREN happen, how to handle financing, and how to sustain federal interest in the NREN. He describes COMSAT and CPB as possible models for the development of NREN. He concludes that a congressionally authorized corporation would provide appropriate representation, flexibility, and leveraging of federal investment.

251. Woodsworth, Anne. Emerging Electronic Library Services. Academic Computing; February, 1990: 26-28, 50.

252. Woodsworth, Anne. The Impact of Globalizing a Campus Library. CAUSE/EFFECT; Summer, 1989: 3-5.
Note: The author is a professor of library science at Pittsburgh.
Woodsworth discusses the recent technological changes that promise to fulfill the dream of instant access to information, data, and documents, regardless of source, or format. She examines the effect of networking on campus information policies, and some of consequences of consortium participation. NREN is not specifically mentioned.

253. Wright, Karen. The Road to the Global Village. Scientific American; March, 1990: 84-94.
This article describes the development of computer and communications technologies and its effect on society, and future potentials.It provides an overview of a wide variety of technologies, including hypermedia, isdn, infotainment, knowbots, multimedia, videotex, and virtual reality. NREN is mentioned briefly as one aspect of the larger technological circus in progress.

254. Wulf, William. Government's Role in the National Network. EDUCOM Review; Summer, 1989; 24(2): 22-26.
Note: Wulf is an Assistant Director at the National Science Foundation.
Wulf discusses the challenges remaining to be addressed in the development of NREN. He briefly reviews the history of the NSFNET improvements and discusses the long range plans developed by FCCSET. He discusses problems in communications between government and technologists. He speculates as to the developments we can expect by the year 2000 and beyond. He

introduces the concept of co-laboratory and elaborates on the potentials it offers.

255. Yavarkovsky, Jerome. A University-Based Electronic Publishing Network. EDUCOM Review; Fall, 1990: 14-20.
Note: The author is director of the New York State Library. This article addresses the issues around the possibility of a university-based electronic publishing network. The need for a commitment to archival storage is raised, as is governance of the publishing network, technical and operational standards, the economics of electronic publishing, and implication and incentives for institutional planners. Included in the article are several sidebars written by other authors on topics related to electronic publishing. The article is based upon the author's presentation at the June, 1990 meeting of the Coalition for Networked Information.

Source Index

%@:: A Directory of Electronic Mail Addressing and Networks

77

Academe: Bulletin of the American Association of University

65

Academic Computing

42
58
86
120
122
148
200
251

Advances in Library Automation and Networking

140

American Libraries

59
75

American Technology Preeminence Act of 1990.

212

ARL, Cause, and EDUCOM announce the Coalition for Networked

20

ARL: A Bimonthly Newsletter of Research Library Issues and A

1
176

ARL: Bimonthly Newsletter of Research Library Issues and Act

247

ARL:a bimonthly newsletter of Research Library Issues and Ac

2
169
173

174

Bottom Line

80

Bulletin of the American Society for Information Science

128
170

Business Week

83

Byte

74

C & RL News

93
165

Campus Networking Strategies

15

Campus Strategies for Libraries and Electronic Information

16

CAUSE/EFFECT

97
126
177
252

Chronicle of Higher Education

191
207
208
209
210
239
240
241

Citizen Rights and Access to Electronic Information: a colle

183

College and Research Libraries News

36
92

Communications of the ACM

181

Communications Week

76

Computer

178

Computer networks and high performance computing: hearing be

223

Computer Networks and High Performance Computing: Hearings b

213

Computers in Libraries

5
96

Computerworld

8
9
10
11
12
13
14
26
27
28
53
99
100
101
195
196
197

Connecting the Networks: Proceedings of the Joint Library of

124

Data Channels

98

Database

164

Datamation

199

Department of Energy High Performance Computing Act of 1991

216

Department of Energy High-Performance Computing Act of 1989:

215

Department of Energy High-Performance Computing Act of 1990

214

DLA Bulletin

67

Educational Record

34

EDUCOM Bulletin

30
64
90
105
112
113
139
179
237

EDUCOM Review

17
23
32
35
47
48

87
89
102
110
114
115
116
129
138
143
159
175
186
187
188
189
190
192
231
232
236
245
250
254
255

Electronic Library

40

Electronic Networks, the Research Process, and Scholarly Com

141

Federal Computer Week

136

Federal High Performance Computing Program

211

Fiber Networking and Telecommunications

131

Gaining New Ground: Technology Priorities for America's Futu

54

Grand Challenges: High Performance Computing and Communicati

168

H.R. 3131, the National High-Performance Computing Technolog
228

Harvard Business Review
82

High performance computing and communications: Investment in
78

High Performance Computing and Networking for Science-Backgr
217

High performance Computing: hearing before the Subcommittee
229

High-Performance Computing Act of 1990: report of the Senate
224

High-Performance Computing Act of 1991
226
230

High-Performance Computing and Communications Act of 1991: h
225

IEEE Communications Magazine
119

IEEE Spectrum
24

Information Literacy: Revolution in the Library
33

Information Technology and Libraries
52

Information Technology and the Conduct of Research: The User
155

Information Technology Quarterly

198

Information Today

3
162

Informing the Nation: Federal Information Dissemination in a

218

Intellectual Property Issues in the Library Network Context:

125

International Journal of Supercomputer Applications

72

Journal of Library Administration

60

Keeping the U.S. Computer Industry Competitive: defining the

150

Library Administration and Management

37

Library and Information Science Research: perspectives and s

117

Library Hi Tech

127
205

Library Hi Tech News

109
123
182

Library High Tech

25

Library Journal

55
66

Library Perspectives on NREN: the National Research and Educ

172

Linked Systems Project: A Networking Tool for Libraries

71

Linking researchers and resources: the emerging information

21

LITA Newsletter

45

Matrix: Computer Networks and Conferencing Systems Worldwide

180

MOSAIC

249

National Challenge in Computer Science and Technology

151

National Computing Initiative, the agenda for leadership

202

National High-Performance Computer Technology Act of 1989. H

227

National High-Performance Computer Technology Act.

220

National High-Performance Computing and Networking Act

219

National Higher Education Network: issues and Opportunities

62

National Journal

149

National Library of Medicine Long Range Plans Improving Heal

152

National Research and Education Network (NREN): Promise of N

29

National Research and Education Network (NREN): Research and

142

National Research and Education Network and the Federal Depo

7

National Research and Education Network: Special Report 90-2

69

Network World

88
145
146
147
194

Networks and ISDN Systems

38

New York Times

135

NREN: The National Research and Education Network

49

Occasional Papers, University of Illinois Graduate School of

111

Online

18
19

Online Libraries and Microcomputers

130

PC Week

118
248

Proposal for an ARL/CAUSE/EDUCOM Coalition

244

Public-Access Computer Systems Forum

46

Publishers Weekly

201
242
243

Report to the Office of Science and Technology Policy on Com

70

Research & Education Networking: the newsletter for Educatio

144

Research and Development Strategy for High Performance Compu

68
167

Research and Education Networking

61

Research in Very High Performance Computing: Policy Recommen

221

Research Technology Management

233

Resources Binder

50

Science

22
137
171
238

Scientific American

31
43
51
57
84
106
108
132
160
203
206
246
253

Seeking Solutions: High-Performance Computing for Science-Ba

222

Supercomputing Review

94
95

Target Edition No.40(Supplement to Infoworld)

73

Technology Review

56

Telecommunications

81
163
235

Toward a National Research Network

154

User's Directory of Computer Networks

121

Whole Earth Review

107
234

Wilson Library Bulletin

44
204